Operational Level Graphics
A Picture of Progress

A Monograph
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ABSTRACT

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This study investigates the adequacy of doctrinal tools to meet the demands of command and control at the operational level of war. Specifically, the focus of this monograph lies in the realm of how American operational-level commanders and staffs graphically portray and communicate their concepts for campaigns and major operations. The purpose is to answer the research question:

How should military graphics support command and control at the operational level of war.

The monograph introduces several theories, concepts, and background information that frame basic command and control (C^2) issues. This framework drives the discovery of deficiencies and the resulting development of a set of proposed solutions. The AirLand Battle Future concept is also introduced to establish the azimuth for future doctrinal requirements in C^2 support.

Three historical vignettes are discussed to add depth and perspective to the a developing list of graphics proposals. The initial list comes straight from the theory and concepts associated with command, control, and campaign planning. The historical vignettes apply these proposals to past events to ensure validity and to add items stemming from past experiences. The result is a framework of graphics proposals that apply to today's and tomorrow's C^2 needs.

The final step in the monograph takes criteria developed in FM 101-5-1, Operational Terms and Symbols, and applies the operational-level graphics framework against it. One additional criterion is developed to accommodate the proliferation of computers and digital transmission devices. Graphics must now be electronically transportable to be useful. The results of this analysis show that the graphics proposals meet the criteria although some doctrinal deficiencies still need to be approved.

The conclusions of the monograph confirm the need to begin detailed development of operational-level graphics to support command and control requirements, today and tomorrow. The most significant implication from this is the need to eventually expand the effort to include the other services. With operational-level warfare inevitably consisting of joint forces, the need for joint graphics support will continue to develop as we move into the 21st century.

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PART I. **INTRODUCTION**

> *The theater of war CINC has an obligation to his subordinate commanders to translate broad strategic guidance into the operational direction that is required to coordinate military effort within his theater...This information presents a complete picture of the CINC's vision for the theater from the beginning of the campaign through various phases to the achievement of the strategic objective.*1
>
> *Mendel and Banks*

Operations Desert Shield and Desert Storm have served notice to the world that the American practice of operational art may be as sophisticated and successful as the world has ever seen. First, American leadership generated the forces and maintained the coalition. American commands then began to knit the strategies, operations, and tactics together into a seamless tapestry. What resulted was the destruction of a once powerful Iraqi Army. Success came with a minimum expenditure of men and materiel. The results demonstrated the clear superiority of American technology and materiel.

Success also focused attention on the skills and expertise displayed by the operational level staffs as they formulated the plans that achieved such stunning results. This monograph assesses some of the command and control graphic tools that were available to General Schwartzkopf and the staffs as they planned and executed this overwhelming victory. The general theme of this study is the adequacy of doctrinal tools to meet the

demands of command and control (C^2) at the operational level.

More precisely, the focus of the monograph lies in the realm of how American operational-level commanders and staffs graphically portray and communicate their concepts for campaigns and major operations. As the most recent example of this art, Desert Storm may provide a good check of the results of this study. However, because of classification constraints and the lack of an appropriate "historical perspective", it is not sufficient as the sole basis of the study. Instead, I have expanded the research base beyond current experience, doctrine, and theory to include several other historical vignettes. In addition, I will take a look forward to the Army's emerging doctrines and concepts.

I use these different examples and experiences to develop a list of requirements that the Army's graphics doctrine should include in order to provide a full "tool box" for the operational level commander and his staff. Martin Van Creveld observed:

> *Napoleon, it will be remembered, was able to revolutionize war by employing organizational and procedural means in order to overcome and transcend the limits imposed by the technology of the time.*2

At a time when microcomputer technology provides established capacity to analyze, integrate, and distribute data anywhere the commander may need it, the

"procedural means" of operational-level graphics hold promise for being able to help transcend the technological limits of today and tomorrow. Graphics designed solely for tactical use are inadequate to do this at the operational level.

While the doctrinal, theoretical, and historical examples provide a base for determining what the requirements for graphics are at the operational level, the criteria for judging potential solutions to the problem of graphics are based in Army Field Manual 101-5-1, Operational Terms and Symbols. Any new graphics should conform to the manual's standards of simplicity, uniformity, and clarity.[3] In addition to these criteria found in doctrine, add one more - transportability. Any proposed graphics should be equally compatible with the traditional medium of "grease pencil and acetate" as well as with modern digital transmission devices which are being so liberally distributed to the operational-level command posts. The proposals and conclusions of this monograph address and conform to all four of these criteria.

This paper is organized to introduce first the selected topic, the general components of analysis, and then the specific research question. After this introduction, Part II includes the theories, concepts, and background information that frame the C^2 issues. This

section includes more detailed discussions of the current doctrines for Army and joint operations. The purpose of Part II is to establish what the requirements actually are and to compare those with existing doctrine to determine the real deficiencies in graphics support at the operational level.

Part III of this paper contains an analysis of three historical vignettes from the viewpoint of adding depth and insight to the treatment of the deficiencies identified earlier in the paper. The vignettes include the joint and combined aspects of Operation Market-Garden, Operation Chromite, and finally, some initial impressions from Operation Desert Storm. These vignettes provide direction as to what may be the future requirements for AirLand Battle Future (ALBF) doctrine based upon recurring needs of past operations.

Part IV consists of the analysis of how well the requirements developed and refined in the theory and history sections comply with the criteria of simplicity, uniformity, clarity, and transportability.

Part V contains conclusions and implications. These results are specific and based on the research question:

> *How should military graphics support command and control at the operational level of war?*

This paper answers the question by reviewing the proposed framework of graphics to establish support of C^2 in

campaigns and major operations. The objective of the paper is to develop a structure for operational-level graphics that meets both current Army needs and the joint and combined needs of future doctrines.

PART II. C² - TODAY AND TOMORROW

> *Operational level command and control includes various size forces. It includes control of operational forces during operational movement and operational maneuver through the depth and space of the theater or area of operations to ensure a coordinated, synchronized, mutually supported effort.*4
>
> *TRADOC Pamphlet 11-9*

Command and control at the operational level of war is a multi-faceted system that encompasses such different functions as determining operational actions and providing operational command presence. Given this expanse of functions, it is necessary to focus on the particular ways that command and control functions can benefit from graphics support. The search for these ways begins with a review of current thought on the specifics of command and of control before the terms combine into the ubiquitous term, "C²".

After examining the different nuances of both command and control at the operational level, it is beneficial to see how the Army is incorporating these concepts into the battlefield framework at the operational level. The result is a full appreciation of how a seemingly minor refinement in C² capability can

have a significant increase in overall force capability. This new appreciation of force capability can then be further tuned by investigating the Army's emerging doctrine called AirLand Battle Future (ALBF).

By investigating ALBF from the standpoint of potential C^2 directions and requirements, the azimuth for graphics development can better stay in concert with the other developing battlefield functions. In order to do this, I will isolate the emerging force structures and missions that best apply at the operational level to the practice of future war, ALBF style. These ALBF findings will conclude the conceptual and theoretical portion of the study after one last look at the current doctrinal status of campaign planning.

The purpose of wrapping theory, concepts, and emerging doctrine with current campaign planning thought is to develop a suite of operational-level graphic tools for use across the different C^2 functions. By closing Part II with a list of graphics that conforms to today's tenets of campaign planning, we can better look at some historical vignettes in Part III. This effort will further refine our appreciation of the potential impact of graphics on C^2 at the operational level of war. But first, we need to have a solid understanding of what the terms command and control really entail.

The current Commander, Training and Doctrine Command

(TRADOC), General John W. Foss breaks the *command* term into three components that he calls precepts. These three, *vision, freedom of action,* and *responsibility* form the basis for a successful command system.[5]

The first of these precepts, *vision*, centers on the articulation and transmission of commander's intent. The problem is that trying to adequately articulate "commander's intent" can be extremely difficult if the drafter is constrained to the written word.

It is even difficult to arrive at a consensus definition of "commander's intent" and what it should contain. At the operational level of war, the effects of battles over time can be more important than the particulars of the battles themselves. This focus on effects provides a good starting point for determining what commander's intent really is at the operational level of war.

While there is no currently approved definition of "commander's intent", a consensus is forming within the TRADOC community that:

> *Intent is the commander's stated vision which defines: the purpose of an operation; the end state with respect to the relationship among the force, the enemy, and the terrain; and briefly how the end state will be achieved by the force as a whole.*6

The implication of this definition at the operational level is that to understand the intent of the strategic-level commander, the operational-level commander keys on

the strategic end state. He then continues the process by piecing together the operational level effects that match the stated purpose of the campaign. The operational-level commander uses this developing relationship of effects to build his vision of the campaign for transmission to his own subordinate commanders. Graphics that assist in the understanding of these *effects* are important. The graphics must be simple, uniform, clear, and transportable. Further, graphics that can place effects in the proper *sequences* offer an immediate advantage to both the operational-level commander and his subordinates. With a proper understanding of intent, the subordinate commanders have an easier time exercising the initiatives and freedom of action that achieve the results that their commander needs.

Freedom of action, the next precept, flows from the proper communicating and understanding of the commander's intent.[7] If a subordinate commander has a grasp on the intent, the next important component of a successful command system is the retention of freedom of action. Too often, we think of the enemy as the threat to friendly freedom of action. Unfortunately, a smothering set of task-oriented missions can be just as debilitating as enemy action at the operational level of command. By offering subordinate commanders a set of effects to achieve through sequenced missions, the operational-level

commander promotes the freedom of action that results in seized opportunities rather than opportunities lost.

This sounds straightforward, but the clear and simple articulation and uniform depiction of the relationships between sequential missions and effects is easier said than done. Graphics that can accomplish this and still be transportable become a very valuable addition to the set of techniques that are available to the command system.

The final precept of a successful command system is *responsibility.*[8] General Foss correctly points to the designation of the main effort as the key to articulating and fixing responsibility in a command system. The implications that are attendant with being identified as the main effort are well known and understood down to tactical level. If the vision and freedom of action are properly articulated, this is really the only other action that needs to be taken to line up the responsibilities of all the commanders involved. From the stand point of graphics, this is the first time that existing tools offer a legitimate partial solution to the problem.

The double arrowhead that depicts the *main effort* in tactical operations is a simple, uniform, and clear symbol that accurately portrays the same message at the operational level. The only missing element is a

designation for the *priority theater of operations* which differentiates it from supporting theaters of operations.

While the above precepts of a successful command system are positive by nature, control tends to take on negative connotations. The goal must be to control by accentuating the positive aims of vision, freedom of action, and responsibility, while avoiding the negative effects of too much control.

At the operational level, control begins with articulating the mission.[9] Because of its focusing effect on all actions and activities of an organization, the mission is the most basic form of control. The mission flows directly from the commander's vision. As such, it can retain the positive aspects of command while minimizing the restraints or constraints inherent in control. The engagement of the enemy center of gravity is the logical mission for a force at the operational level.

If the engagement of the *center of gravity* cannot be accomplished directly, then the Jominian concept of identifying *decisive points, objective points, and lines of operations* becomes the necessary (and more restrictive) means of control. The ability to graphically portray this concept without unintentionally adding any more implied means of control becomes a boon to both command and control.[10]

Along with mission, the use of a common doctrine

provides another component of control. As General Foss clearly explains it, *"Higher commanders expect their subordinates to understand, apply, and act within the tenets of Army doctrine."*11 This expectation is built around published documents and a formal education system that teaches the doctrine itself. The impact of this expectation on operational level graphics is the requirement to understand joint doctrine. Just being able to understand the Army's doctrine is not good enough. Each of the other services' tenets must be understood to minimize the need for any further overt control. The impact of this on graphics support is the need to accommodate the services' requirements at the operational level. This monograph focuses on the suite of Army requirements and some common needs. The obvious progression of this effort is to eventually incorporate all services' requirements into the *joint doctrine.*

The last component of control is graphic control itself. Every graphic utilized in support of a plan or order becomes a form of control. Therefore, the more exact that a graphic can match the intended purpose the less "collateral" control imposed. The farther the actual graphic deviates from the purpose of the control, the more chance for unintended and possibly onerous control to be imposed.

The effects of inappropriate use of graphic control

is the biggest objection to using multiple tactical level graphics in support of a concept originating at the operational level. An example of this is trying to depict a center of gravity as a series of tactical objectives. An operational-level center of gravity is almost always a force.[12] However, as soon as tactical objective symbols are placed on the subunits, the objectives become tied to the terrain that the units occupy. This remains in effect, with no provision for accommodating a "moving target"! The result is unintended control and reduced freedom of action.

The above nuances of command and of control are subtle, but distinct, as they act as the basis for formulating graphics support requirements for the operational level of war. Even when combined into the single term, command and control (C^2), these nuances remain. When the Army doctrine requires action of the commander, the graphics for the action must support both the command and the control of the force in this action.

Up to this point, we have looked at the requirements for these graphics based on C^2 as a stand alone function. These requirements will come into sharper focus by examining C^2 as it is integrated into current doctrine and future doctrinal trends.

The integration of C^2 into the Army's framework of campaigns and operations begins with FM 100-5. The

implication that this has for graphics support is apparent:

> *Reduced to its essentials, operational art requires the commander to answer three questions:*
>
> > *1. What military condition must be produced in the theater of war or operations to achieve the strategic goal?*
> >
> > *2. What sequence of actions is most likely to produce that condition?*
> >
> > *3. How should the resources of the force be applied to accomplish that sequence of actions?*13

Graphics designed to support the commander in this endeavor must support the specified and implied tasks in each of the three questions of operational design. The first question deals with end states. The second question deals with time and effects. The third question deals with responsibilities. While the focus of each question is different, the answers only have operational significance after they are combined. The challenge to graphics support is to combine these answers into that package.

The first element of the package is the depiction of the *military end state.* In most cases, this means the defeat or destruction of the enemy's center of gravity. As has already been discussed, the graphic depiction of this condition must be able to identify the unit/force that is involved. It should be capable of remaining

detached from a particular terrain feature that the unit happens to be occupying at any particular time.

In addition, the depiction of the center of gravity must stand out as the key graphic among all the other graphics. It takes the place as the centerpiece for all resulting actions. As Mr James Schneider wrote in his essay, The Loose Marble, *"Rational human action begins with the establishment of ends or aims. In warfare this may be the single most important decision a commander can make."*14 The graphic that depicts the end military condition should reflect this importance.

The second operational question requires graphic support to depict *effects* and the *temporal relationships* between the effects. This requirement forces the graphic support to expand beyond the traditional objectives and phase lines used for tactical control. The commander may envision the center of gravity as vulnerable only through the successful destruction of multiple objective points in a particular sequence. Graphic support must make this clear to subordinate commanders.

The last operational question deals with associating specific units and capabilities with responsibilities for accomplishing the necessary effects. Implied in this requirement is the ability to allow for changing responsibilities over time. Traditional tactical-level graphics often attempt to depict these responsibilities

as tasks such as "screen" or "defend battle position". These graphics are unable to depict changes in these responsibilities, once they are assigned. At the operational level, this amounts to applying too restrictive and too much control. The optimum graphic support simply correlates the *units with the effects that they are to achieve* at any particular point and time in the operation.

Given the need to deal with all three operational questions at once, it is apparent that traditional graphic techniques are unsatisfactory. One emerging graphic technique that might be of use for this purpose is the *matrix*. With entry arguments of time (either real time or arbitrary increments) and responsible agents (usually units), objective points can be ordered and sequenced to depict the entire campaign plan up to the actual engagement of the enemy center of gravity. The advantage that the matrix has over traditional symbols is its ability to accommodate written words. This is critical at the operational level where the commander is operating in both joint and combined environments. The matrix allows him to convey effects such as "air superiority over the main effort and air parity through the remainder of the theater of operations." With the matrix, command attention can be directed to the effects without having to depict an overly restrictive "roadmap"

to get there.

While the matrix may have utility as it is in support of today's C^2, the course of future doctrinal development is being set along the lines established by the AirLand Battle Future (ALBF) concept. It is important to investigate this concept for any peculiarities that it may inject into the graphic support process.

While ALBF undeniably places emphasis on the continued acceleration in developing intelligence and fire systems, another main emphasis of the concept remains fixed on corps level operations on a non-linear battlefield. ALBF suggests that the corps may be the operational-level headquarters in some contingency operations. The contingency operations themselves will consist of five phases; *"Predeployment/crisis action, deployment/initial combat operations, force buildup/combat operations, decisive combat, and redeployment."*15 While most of these phases are tactical in nature and lend themselves to tactical graphics, there are some operational twists to the graphics requirements.

First among these twists is the recognition that the future will place greater emphasis on force-orientation instead of terrain-orientation. This emphasis manifests itself in discussions of the nonlinearity issues. Graphics support for this effort must accommodate the

emphasis on force identification separate from the terrain that they occupy. This accommodation fits nicely with the force identification approach that the study has already identified as desirable.

The second twist concerns the units and effects that can be expected to be operationally portrayed. The operational level commander may well be a joint task force commander with responsibilities in land, sea, air, and space environments. In addition, he may have combined responsibilities. Therefore, the graphics support must accommodate all these players.

The third twist deals with the time and sequences that the commander will have to include in his vision. The campaign will have to stretch from mobilization through lodgment to final military end state. Because of the expanse of time and geographic distances involved, matrix supplementation of traditional graphics techniques is probably necessary. The matrix technique already described may be adequate for this support requirement.

In all, this glance forward toward future doctrinal thought and developments tends to reinforce the initial assessments made from current C^2 theory and doctrine. The last step in this phase of the monograph is to determine how these insights match against the current state of campaign planning.

According to the Joint Chiefs of Staff Test

Publication 3-0, what is important to operational command is:

> *To ensure that subordinate operational commanders respond to tactical outcomes consistent with CINC intent, CINCs must:*
> *(1) Define goals by articulating the strategic and operational results sought.*
> *(2) Describe the planning assumptions that led to the initial operational concept to be pursued.*
> *(3) Describe any operational restrictions that might inhibit the flexibility of subordinate commanders.*16

The foregoing discussions of command and control have pointed the design of graphics toward some "minimums" which should be met. The quote from Mendel and Banks that leads off this monograph introduces some specifics on how the CINC begins to fulfill his obligations to his subordinate commanders.[17] These specifics lead into a series of campaign planning tenets that form a base of minimums that require graphics support. These minimums include *units associated with their "effects responsibilities", identifying the enemy center of gravity, overarching concepts with phasing and contingency concepts, command relationships, task organization by phases,* and *logistical concepts for sustainment.*18 The specifics drawn from the monograph include *depicting commander's intent through effects, sequence, constraints and restraints, time/unit/objectives relationships, facilitating freedom of action, identifying priority and supporting theaters*

of operations, decisive and objective points, and lines of operations.

These items form the first cut of minimum requirements for graphic support of operational command and control. They have been identified from a theoretical and doctrinal investigation. It is now appropriate to look at these requirements in conjunction with historical examples. The purpose is to see how these items fit in the support of the command and control of actual campaigns.

PART III. Campaigns - Yesterday & Today

> *The aim must be circulated...so that subordinates can make it the focal point of their planning. There must be no doubt as to what the military force is to achieve.19*
>
> *NATO ATP-35*

Doctrinal and theoretical study of issues is important from the standpoint of focusing issues and suggesting reasonable courses of action. For the purposes of this study, the doctrinal and theoretical approaches have led directly to a list of candidates for graphics representation. The items on this list remain just candidates until they have been validated by their relevance to the historical perspective of past campaigns.

I will subject this list of candidates to three campaigns; Market-Garden, Chromite, and Desert Storm.

These campaigns have been chosen because they each share several traits. The candidates are all joint operations and all include a combined force component. Finally, the campaigns combine the basic mission sequence that ALBF postulates as the norm for the foreseeable future. The first phase begins with a strategic movement to lodgment areas. The campaigns are designed to then continue in a designated sequence through a series of distinct objective points toward a decisive engagement. This decisive engagement promises to decide the campaign in concert with the vision of the commander. I will describe these campaigns in terms of several of the campaign plan tenets mentioned in Part II and detailed in the US Army War College's document, Campaign Planning.[20]

While Market-Garden, Chromite, and Desert Storm share many traits, the one trait that they do not share is success. In the case of Market-Garden, failure was complete, but possibly preventable. The failure was in the cybernetic domain and revolved around a faulty commander's vision. While the investigation of graphics support will generally focus on relevancy to success, the vignette on Market-Garden will expand to consider whether better graphics support could have helped to mitigate the failure of this operation.

OPERATION MARKET-GARDEN

By the 11th of September, 1944, allied forces of General Eisenhower's invasion armies had completed the breakout of the Normandy beachheads. American forces advanced east to threaten Germany proper. United Kingdom forces advanced to the north and east to seize Antwerp, open more port facilities, and threaten the Ruhr valley from the north.

The German Army was stunned. The bulk of its combat forces had just narrowly missed complete destruction during the attempted closing of the Falaise pocket. On a macro scale, resistance was crumbling as elements of the UK Second British Army seized Antwerp and crossed the Meuse-Escaut Canal.

However, the exact condition of German forces in the Netherlands and the northern approaches to the Ruhr valley was not exactly as depicted on the macro level. The 2d Army was beginning to encounter an enemy that was reorganizing defenses based on the numerous water obstacles that faced any British move into the Netherlands.[21] The British command recognized what the German intent was, and recognized the need to disrupt this effort before it could become effective. At the same time, the lines of communications for the 2d Army now stretched for over 400 miles. Because the port facilities of Antwerp were not yet operational, the British

logistics effort was tied to an extremely long road network. The British command was caught in the dilemma of having to choose between accepting either an operational pause while it straightened out its logistics problems or pushing on a narrow front to continue the disruption of the German defenses. If the British paused, they would have to accept stiffened German resistance when it came time to resume the move north. Pushing on required SHAEF assets and risked culmination.

The British, with concurrence from General Eisenhower, decided to accept the risk. The plan for this major operation changed from Plan "16" to "Market Garden".

The analysis of the plan for Market-Garden begins with the first campaign plan tenet; *"Provide a broad concept of operations and sustainment"* which should *"provide the basis for all other planning."*[22] Market-Garden, as a broad concept, consisted of a 5 corps operation to open a corridor north to sever the low countries from Germany and begin the move to the Ruhr valley from the north. Two airborne corps would seize canal and river bridges and the route along the corridor from Eindhoven, past Nijmegen, to the Rhine River Bridge at Arnhem. The main effort would be conducted by one corps advancing quickly on a narrow front from La Colonie to link up with the airborne corps and move to "dominate

the country to the north as far as the Zuider Zee." The remaining corps provide flank security for the main effort.[23] The concept of sustainment included opening the ports of Antwerp, line haul over road from France, and air sustainment from England. As a basis for other planning, this concept seems reasonable. There is no indication that any confusion existed concerning the broad concept. The opportunity for graphic support to improve on the concept's acceptance and understanding in this area is probably minimal at best. However, the items that would be appropriate for graphic representation include the *theater of war, theater of operations, lines of operations, lines of sustainment, objective points, decisive points,* and finally, the *operational pause* that occurred on the Meuse-Escaut canal.

The next two tenets - displaying the commander's vision and intent, and orient on the enemy's center of gravity, are found in the 21st Army Group plan for Market Garden:

> *(a) To advance eastward and destroy all enemy forces encountered.*
>
> *(b) To occupy the RUHR and get astride the communications leading from it into GERMANY and to the sea ports.*24

Unfortunately, this intent became confused and distorted as it circulated within command channels and when interpreted by subordinate units. The orientation on the center of gravity was totally lost. To determine

where the operation was headed, one need only to look at the interpretation of the plan by Montgomery's key subordinate commanders. The Commander, XXX Corps, Lieutenant General Horrocks briefed the operation to his officers and commanders as a narrow breakout emphasizing speed and shock in order *"to pass 20,000 vehicles over the highway to Arnhem in sixty hours."*25 There is no question that LTG Horrocks had identified this operation as a method by which the 2d Army could move quickly across the Rhine to establish maneuver advantage in preparation for a move against the Ruhr. What is missing in LTG Horrocks' vision is the higher command's original vision of the destruction of German forces. LTG Horrocks had been seduced into considering Arnhem as the center of gravity instead of more correctly identifying it as an objective point.

Even at this early point in the operation, it is apparent that the operation was beginning to focus on terrain objectives. This same shift in focus to terrain was even evidenced by the Commander, 21st Army Group, Field Marshall Montgomery. Even though he was the one who had originally seen and articulated the need to destroy the German forces, Montgomery was beginning to lose sight of his own vision and the enemy's center of gravity!

The intelligence staff at SHAEF identified the presence of two Panzer divisions in the Arnhem area 48

hours prior to the operation. LTG W. Bedell Smith flew to advise Montgomery on the presence of the enemy armor. The response from the Commander of Market-Garden was that the terrain would cause more problems than the Germans.[26]

This same vision shift to terrain and mobility at the expense of focus on enemy forces was reflected by LTG Browning, Commander of the airborne effort. Browning envisioned *"a carpet of airborne troops down over which our ground forces can pass."*27 With attention becoming diverted to terrain interests so quickly and at such a high level, it is easy to see how the presence of German armor could be denigrated even though the original vision included force destruction.

The practical result of this error was that the presence of German forces in general, and the armor assets in particular, became a threat to the objective points rather than the focus of the allied efforts. As such, the Panzer forces that were known to be in the vicinity of Arnhem became a tactical force to be defended against rather than an operational force to be engaged and *destroyed*.

It is a fact that allied planners did not have a symbol to depict the *center of gravity*. However, if one had been available, it might have been put to good use. Had an appropriate graphic symbol been attached to the Panzer units at the initial planning sessions to identify

them as the center of gravity, perhaps the command vision would have been able to stay focused long enough to at least prevent the ensuing tragedy. Along with portraying centers of gravity (both enemy and friendly) the other graphic measures that would have had utility in support of the two tenets of vision and center of gravity include the *priority theater of operations,* and *main effort.* Other applicable graphics measures include *sequels* resulting from success against the center of gravity, and *branches* at *decisive and objective points.* Finally, accurate descriptions of the *effects to be achieved at the objective points,* e.g. destroy German forces, occupy Nijmegen-Groesbeek Ridge, and control bridges, complete the set of graphics requirements.

The fourth tenet, *"Phases a series of major related operations",* is a deceptive tenet to evaluate in this campaign. It is very easy to confuse very detailed schedules and timings as phases of an operation. In reality, such detail is actually a form of tactical synchronization. Operational phasing has more to do with the sequencing of effects than it has to do with scheduling tasks.

The 21st Army Group plan for Market-Garden was full of the details required for backward planning an airborne operation. Unfortunately, like the shift in vision toward terrain, the planning reflected the emphasis on getting

to Arnhem in force as quickly as possible. As such the artillery preps were established in great detail to support the movement of XXX Corps along the route. There were no schedules for the destruction of German forces. The timing of the XXX Corps breakout was carefully timed to the airborne drop, but there was no attempt to phase the effects that each effort might have on the German forces. Had the effects of the breakout on German armored reserves been considered in the same sequence with the effects of the air drops on enemy C^2, then perhaps the decision might have been to launch the air drops after the physical disintegration of German defenses had begun to occur. Graphics that could have portrayed effects within these sequences might have illuminated the opportunities. Instead, tactical graphics depicting the sequence of tasks were used that tended to mask the benefits of the alternative courses of action. The graphics support measures that would have supported this tenet depend on the ability to relate effects with time and responsibilities. Working in these three dimensions in a specific area dictate the use of a *matrix,* tied to the area, with entry arguments being *time* (either relational or arbitrary) and *responsible agents* (e.g. air component commander, special operations commander, land component commander). The desired *operational effect* along with any operationally significant *restraints and*

constraints are found at the intersection.

The final tenet that helps in the analysis of Market-Garden is the need to synchronize all the components of a joint force into a synergistic whole. By virtue of the massive air and land components of Market-Garden, it qualifies as an example of joint efforts on an operational level. While the individual schedules of tasks by each service were well documented in the planning process, the graphics support for the C^2 of Market-Garden reflects the state of modern day graphics doctrine by being strictly land component oriented. There were no graphics which indicated which service was responsible for each desired effect in the sequence leading up to the final desired military condition. Had that been graphically portrayed to fix responsibilities, it might have been noticed that 21st Army Group had tasked the logistics sustainment effort to be done completely by air for the two employed airborne corps! This was to occur at the same time that escort and close air was supposed to be flown in support of the campaign.[28] The important advance in graphics support of this tenet clearly rests in the expansion of joint doctrine to include *joint graphics* portrayal of effects.

Operation Market-Garden was a tragedy for a number of reasons, most of them revolving around the faulty C^2 system that was employed by the 21st Army Group. I do not

mean to imply that operational level graphic support would have turned the defeat into a victory. The plan was far too flawed to be salvaged by anything other than divine intervention. However, the operation does provide an excellent vehicle for displaying the opportunities that operational graphics support may hold for future campaigns. Another campaign that provides an excellent example of a commander's vision that warrants graphics support is Operation Chromite.

OPERATION CHROMITE

Like Market-Garden, Operation Chromite was planned at a time when one combatant was in a state of disorganization and trying desperately to regain a measure of cohesion for its defensive efforts. The key difference is that this time it was the United Nations forces that were trying to constitute a defense in the face of a seemingly overwhelming North Korean (NKPA) invasion. The commander's answer to this desperate situation was to conduct an offensive against the lines of sustainment and communications, disrupt the offensive, and bring about the destruction of the NKPA forces. General MacArthur's vision and broad concept for this campaign are a classic example of the potential benefits that this tenet can bring to a campaign plan. As such, it deserves to be investigated to validate opportunities for

graphics support.

U.N. forces had been rushed to Korea to reinforce the fleeing South Korean Army as it raced one step ahead of the NKPA toward the port of Pusan. The arrival of General Walker and significant numbers of U.S. Army and Marine troops finally stemmed the advance along a series of defensive positions known as the Pusan Perimeter. General MacArthur was presented the option to either mass at Pusan and attack out or conduct an amphibious assault to envelop the NKPA. The problem was that the Pusan perimeter was good for the defense but not so good for an offensive. Additionally, the logical sites for amphibious landings were not conducive to operations against the bulk of the NKPA forces. General MacArthur's solution to the problem astounded and scared his peers. Most importantly, it resulted in the total destruction of the NKPA.[29]

There is no written account of General MacArthur's 23 August, 1950, briefing to several of the Joint Chiefs of Staff on his vision and intent for Operation Chromite, the assault on Inchon. However, General MacArthur did record his recollection of his vision and intent in a masterpiece of the spoken word.[30] I will quote passages of the speech to reinforce the items suitable for graphics representation.

> *The bulk of the Reds are committed around Walker's defense perimeter...The very arguments*

you have made as to the impracticalities involved will tend to ensure for the element of surprise...seizure of Inchon and Seoul will cut the enemy's supply line and seal off the entire southern peninsula...By seizing Seoul, I would completely paralyze the enemy's supply system-coming and going. This in turn will paralyze the fighting power of the troops that now face Walker...

The only alternative to a stroke such as I propose will be the continuation of the savage sacrifice we are making at Pusan...

If my estimate is inaccurate and should I run into a defense with which I cannot cope, I will be there personally and will immediately withdraw our forces before they are committed to a bloody setback...

In this short description of his general concept, General MacArthur has laid out his vision, intent, and purpose for the campaign. Translated into operational level graphics, this description provides almost a complete tapestry of the campaign.

The description begins by identifying what MacArthur considered to be the operational center of gravity, *the bulk of the Reds*. The early tagging of this item precluded the loss of operational focus when tactical issues began to encroach on the operational planners' attention!

MacArthur then began to describe the effects that he most wanted the operation to have on the enemy. While he envisioned *surprise* at Inchon, he also envisioned the resulting *paralysis* on the main enemy supply lines and forces themselves. In contrast, Montgomery never articulated effects in his vision. Instead, subordinate

forces were left to focus on their tasks without an appreciation of what they were really meant to do in terms of the overall scheme.

Not only did MacArthur articulate effects, but he did so in relationship to the areas and the general phases that they would occur. He did this by identifying the operational objective points as Inchon and Seoul. He placed the enemy decisive point at the Pusan Perimeter, and identified the friendly decisive points at the beaches of Wolmi-Do and Inchon. There is no doubt that MacArthur was serious about sequels at the objective points and branches at the decisive points.

The only major items that General MacArthur did not touch on in this short rendition are the linkages to responsibilities and the temporal details to complete the requisite matrices. As a truly joint and combined operation, the operational level planners would still have had difficulty dealing with specific service issues and responsibilities. On the whole, there is no doubt that a coherent rendition of his vision could have been executed given an adequate suite of operational level graphics.

The important thing is that while limited numbers of people received this briefing, and understood it implicitly, the operational planners did not. Until they could get the briefing and translate it into document

form, there is the risk that, like Montgomery at Market-Garden, the vision could be lost. Simple, uniform, clear, and transportable operational level graphics could have helped to capture this moment.

The results of investigating Market-Garden and Chromite for opportunities to use operational level graphics have turned up a number of interesting similarities and several instances where success flowed from one technique and failure from a corresponding but different technique. I will now look at Operation Desert Storm to find either confirming or dissenting instances of opportunities for graphics support of operational C^2.

OPERATION DESERT STORM

Dealing with such a recent significant event presents special challenges stemming from access to classified information and the lack of a proper historical perspective. However, its currency makes up for the shortcomings by establishing an obvious relevancy to trying to anticipate future requirements. There is nothing in the following impressions of the operation that has come out of any source other than the daily briefings from CENTCOM and the resulting rebroadcasts over radio or newsprint. In fact, the information presented by General Schwartzkopf in "open sources" and interviews provides enough of a feel for his concept,

vision, and intent to be able to validate the graphics requirements already established in theory and history.

As in the Market-Garden analysis, the tenets of campaign planning provide a good framework for looking at Desert Storm. The first tenet - Broad Concept - established the need to differentiate between the Kuwait theater of operations and the Iraq theater of operations. Additionally, this tenet provided the opportunity to depict the broad lines of operations and sustainment. These lines should have included not only Army forces, but Air, Navy and Marine forces ashore and afloat too.

The second tenet - Vision and Intent - provided the chance to depict the effects that were intended to be achieved at the different times and locales in the theater of war. These effects ranged from embargo and isolation to surprise and deceit. Finally, General Schwartzkopf could have used graphics to portray the original and shift in priority theater of operations and main efforts from the sea to Kuwait to Iraq, and Navy to Air Force to the VII Corps. In concert with this, decisive points, objective points, and pauses would be contributors to understanding. Included in the list of decisive and objective points would be the Iraqi Air Force and intelligence gathering systems, the Iraqi C^2 and communications systems, Iraqi beach defenses, the fortified infantry positions, the bridges over the Tigris

and Euphrates rivers, and the Iraqi Army assets committed to the Turkish border. The pauses would reflect any anticipated sustainment restraints and any gaps in intelligence coverage through the depth of the theater.

The third tenet - Center of Gravity - was clear from the start. The Republican Guard forces in the vicinity of Al Basrah constituted the operational-level hub of power for the Iraqi government in the theater of war. My impression from news broadcasts early in the Desert Shield/Storm effort is that this center of gravity was identified early on and adhered to throughout the planning and execution. As such, it helped to form a clear focus to the entire campaign. It would have been both critical and easy to graphically portray.

The fourth tenet - Phasing - was as clear in the campaign plan as was the center of gravity. The naval, air, amphibious, deception, and ground operations all lent themselves to the graphical representation with effects, time, and responsible agencies forming the heart of the presentation. Additionally, the operational-level restraint of civilian casualties and constraints on use of coalition forces would have been appropriate for portrayal.

The fifth tenet - designate command relationships - was adequately handled by conventional wire diagrams. Here is a case where immediate analysis is obviously

inadequate. The relationships and responsibilities of Third Army are somewhat cloudy. This may or may not be an instance where an operational twist to the conventional graphics is in order. More information is needed.

The sixth tenet - operational direction and tasks to subordinates - provides obvious opportunities including effects to be achieved by units down to division level, coalition maintenance issues, and assignment of objective points. The simple and clear graphic depictions could have provided direction and tasks for the units from lodgment through assembly and on to their final objective points.

The final tenet - synchronize joint efforts - completes the opportunities for graphic support. This is clearly the most ambitious of the graphics opportunities. It would have covered the effort from the Navy's combined blockade and the Air Force's long term air campaign to the Marine's masterful deception effort. There are currently no uniform joint graphics for these efforts, even though their potential contribution to C^2 support is significant.

As in the vignettes on Market-Garden and Chromite, Desert Storm provides a vehicle for understanding the opportunities for use of operational-level graphics. Even with my admittedly very shallow analysis of this most recent example of conduct of war at the operational

level, it is apparent that there is utility in expanding the current suite of tactical graphics to include operational-level graphics. It is important to keep in mind that the proposals for these new graphics must meet the criteria of simplicity, uniformity, clarity, and transportability in order to be truly useful. In Part IV, I will analyze the above proposals in light of these criteria.

PART IV. ANALYSIS

> *Military Symbols lose their value if they become complicated or cluttered with unnecessary detail...The user must remember that simplicity, uniformity, and clarity are the keys to good military symbology.*31
>
> *FM 101-5-1*

Now that a suite of graphics for use in support of operational-level C^2 has been compiled, we must apply the criteria of simplicity, uniformity, clarity, and transportability. Each of the graphics proposals must be acceptable in order to remain as a viable suggestion for design implementation.

In order to understand the importance of this step, it is helpful to review the dangers to command in the event that poor graphics are implemented. Because command and control are related in a "zero-sum" relationship, control stemming from graphics inevitably impinges on command. This control should be beneficial to the force in the proper circumstance. There is the danger of

utilizing poor or inappropriate graphics and thereby unnecessarily constraining command. The likelihood of this bad side effect occurring is inversely related to the quality and rigor that goes into the graphics design to begin with. The application of the criteria of simplicity, uniformity, clarity, and transportability form a critical step in the design process.

The list of graphics proposals from Parts II and III include: units associated with their responsibilities for achieving specific effects, identifying the enemy center of gravity, overarching concepts with phasing and contingency concepts, command relationships, task organization by phases, and concepts for sustainment. Also making the list are: depicting commander's intent through effects and sequence, time/unit/objective relationships, identifying priority and supporting theaters of operations, joint force effects, decisive and objective points, and lines of operations and sustainment. Finally, the following items are also considered based on historical experience: theater of war, operational pause, direction of branches and sequels, restraints, and constraints.

The methodology for conducting the analysis is to compare each proposal against each of the criteria to identify any that violate a parameter. Those that meet the criteria should be passed to graphics designers for

concept drawings and eventual adoption into the operational planner's tool box.

The results of this process are shown in the following table.

GRAPH PROPSL	TYPE	SIMPLE	UNIFORM	CLEAR	TRANSPORT
Unit/Effects	Matrx	+	X[1]	+	+
Ctr of Gravty	Symbl	+	+	X[2]	+
Concpt/Phases	Matrx	+	X[1]	+	+
Cmd Relations	Matrx	+	+	+	+
Task Org/Phas	Matrx	+	+	+	+
Sustainment	Matrx	+	X[1]	+	+
Intent/Effect Sequence	Matrx	+	+	+	+
Unit/Time/Obj	Matrx	+	+	+	+
Theater Opns	Symbl	+	+	+	+
J/Force Effct	Matrx	+	+	+	+
Decisive Pts	Symbl	+	+	X[2]	+
Objective Pts	Symbl	+	+	X[2]	+
Line of Opns	Symbl	+	+	+	+
Line of Sust	Symbl	+	+	+	+
Theater War	Symbl	+	+	+	+
Opnl Pause	Symbl	+	+	+	+
Branch	Symbl	+	+	+	+
Sequel	Symbl	+	+	+	+
Restraint	Matrx	+	X[2]	+	+
Constraint	Matrx	+	X[2]	+	+

The left column is an abbreviated name for the graphic or symbolic proposal. The next column is what I envision the graphic or symbol to consist of. The basic choices are matrices or symbols. The last four columns depict the ratings for the particular criterion. A "+" means that the criterion is fully met. An "X" indicates either a shortcoming or outright failure.

The superscript is keyed to the reason for the shortcoming or failure. The annotation "X^1" indicates a shortcoming that results from a proposed graphic that is very situation dependent. When a graphic varies excessively based on the factors of mission, enemy, terrain, task, or time, uniformity of depiction begins to suffer. If the preferred graphic is a matrix, it can usually accommodate the divergence in uniformity, and the criteria are met. If the preferred graphic is a symbol, the lack of uniformity may be cause for criterion failure.

The annotation "X^2" indicates a shortcoming in doctrinal definitions. In several instances of this study, I used Jominian and Clausewitzian terms to describe classical concepts that are no longer a part of our doctrinal lexicon. Where this is the case, the graphics proposal remains valid, although either clarity or uniformity may suffer until a doctrinally approved definition is accepted as a "joint term".

The bottom line is these graphics proposals pass the criteria. There is no doubt that each of them can facilitate campaign planning at the operational level of war.

PART V. CONCLUSIONS and IMPLICATIONS

> *A proper command system should be able to set itself goals, and then strive to attain those goals in spite of the clear realization that things will go wrong...*32
>
> *Van Creveld*

This study focused on the opportunities to improve the command and control process at the operational level of war. Specifically, the void in graphics that support operational-level command and control appears to be one area where improvement can be made that will have a positive impact on the Army's overall capability.

The purpose of this study was to answer the question: How should military graphics support command and control at the operational level of war? This was answered with the framework of proposals that met the criteria established in FM 101-5-1. These proposals are designed toward facilitating operational C^2 through the near future as the Army's and joint doctrine evolve into the next century.

CONCLUSIONS

One of the most important lessons emerging from this

effort is that the tradeoff between command and control is a zero-sum game. It is up to the commander and his operational planners to impose the minimum amount of control on the operation in order to facilitate all the advantages that can accrue from a vibrant and opportunistic command process. In order to do this, the graphics techniques that are developed and used must be very carefully considered and used only when necessary and appropriate. The overuse of operational-level graphics can be as stifling and injurious as is the paucity of those graphics that currently exists.

The varied and well refined theories and doctrines of cybernetics that are current today are relevant and help establish the real requirements for graphics. The fact that the historical vignettes did not refute any candidates emerging from the theory is significant. The fact that the potential of many candidates was repetitively advanced shows the high correlation between the theories and actual experience.

IMPLICATIONS

Based on the high correlation between theory and practice, it is time to begin the serious development of detailed graphics specifically designed to support operational-level command and control. The first step in this developmental process has been taken by identifying the opportunity for increased C^2 capability. The next

step is to begin the Army's portion of the solution to the challenge.

Solving the Army challenge is only a beginning in this process. An even greater challenge lies in establishing coherence in the approach taken by each service to this requirement. Operational planners operate in a joint environment. It is just as important for the Navy, Air Force, and Marines to fill in their graphics blanks as it is for the Army to do so. Joint doctrine for campaign planning starts with articulating military conditions and the effects that build to that. The operational planner needs the tools for each services' vision of these effects. It is time to begin this process.

Finally, the experiences coming out of the stunning success of Desert Storm provide both kudos and a stern warning for the future. While the campaign was one of the most brilliant of modern times, it was planned over the space of six months. This allowed ample time for innovation to fill in missing parts. Our enemies are now forewarned! From now on, it would be most prudent to deploy to the theater with the planner's tool box already full.

END NOTES

1. William W. Mendel and Floyd T. Banks, Campaign Planning: Getting it Straight, 1988: pg 47.

2. Martin Van Creveld, Command in War, 1985: 191.

3. Headquarters, Department of the Army, Operational Terms and Symbols, 1985: pg 2-1.

4. US Army Training and Doctrine Command, Blueprint of the Battlefield, 27 April 1990: 14.

5. General John W. Foss, Command, May 1990: pg 3-7.

6. This definition is extracted from a message drafted by the Deputy Commandant, Command and General Staff College, 9 October 1990. According to the message, the definition is the result of a consensus reached during the September, 1990 TRADOC WARFIGHTER Conference. Participants included General Foss, TRADOC Commander, and the TRADOC Commandants.

7. Ibid, pg 4.

8. Ibid.

9. Ibid.

10. Frederick Kienle, Operational Graphics: Can a Picture Be Worth a Thousand Words, Monograph, Fort Leavenworth, KS, April, 1991. In an exceptionally creative paper dealing with the general subject of graphics development to support the operational level of war, Major Kienle and I have chosen parrallel tracks in many areas. As such, he and I have developed mutually supportive ideas that will appear from time to time in this paper. The basic differences occur due to his focus on symbology, while I focus on development of concepts supporting C^2. As this passage indicates, we are both involved in the search for more effective command and control at the operational level.

11. Ibid, pg 4.

12. This statement is made on the basis of a number of very fine articles, the best of them being written by Colonel Lawrence Izzo. While I cannot quote any one in particular, I feel certain that it remains a faithful representation of his views. They are views that I wholly

subscribe to with respect to finding a center of gravity anywhere else than in the force itself, at the operational level of war.

13. US Department of the Army, Field Manual 100-5 Operations, 1986, pg 10.

14. James Schneider, The Loose Marble, 1989, pg 17.

15. US Army Combined Arms Combat Developments Activity, AirLand Battle future, the Evolving Concept, 1990, pg 7.

16. Joint Chiefs of Staff, Doctrine for Unified and Joint Operations, JCS Pub 3-0, January, 1990: pg III-6.

17. William Mendel and Floyd Banks, Campaign Planning, 1989, pg 4.

18. William W. Mendel and Floyd T. Banks, Campaign Planning: Getting it Straight, pg 47.

19. NATO, ATP-35, Land Forces Tactical Doctrine, pg 1-1,1-2.

20. Colonel William Mendel and lieutenant Colonel Floyd Banks, Campaign Planning, 1988, pg 8. The tenets for campaign planning identified by Mendel and Banks are derived from their analysis of the state of campaign planning being executed in the field. The formal doctrine for campaign planning is currently restricted to FMFM 1-1, Campaigning. While this is a good overall synopsis of what must be done, it is too limited to suffice as the bedrock of future joint doctrine.

21. Second British Army, Summary of Second British Army Plan, "Operation Market Garden", 25 Nov 1946, Part I, Section 1, para 1-2.

22. Strategic Studies Institute, Campaign Planning, 1988, pg 8. This list of tenets that appears in the executive summary portion of the document provides the basis for the tenets as they are listed in the remainder of this monograph. It is important to note that these tenets are not formally approved doctrine, but they do capture the essence of campaign planning as it is described both in the document and in the observations of actual practice in the field.

23. Ibid, Part I, Section 2, paragraph 2.

24. 21 Army Group, Notes on the Operations of 21 Army Group, 6 June 1944 - 5 May 1945, 25 Nov 1946, Section 4A, paragraph 89.

25. Cornelius Ryan, A Bridge Too Far, 1974, pg 166. This quote appears in quotations as an indication that these are LTG Horrocks' words. Because there is no accompanying documentation, I am assuming that this is an accurate representation of what the Commander portrayed as his vision of the operation.

26. Ibid, pg 158.

27. Ibid, pg 132. This passage is also reflected as a direct quotation. However, it is unclear whether it is the words of LTG Browning or the recollections of his words by Major Brian Urquhart, the intelligence chief, I Airborne Corps. The graphics used by the 21st Army Group add credence to these being Browning's thoughts if not his exact words. The graphics focus entirely on the route with accompanying verbiage alluding only to the route and the Nijmegen-Groesbeek ridge line.

28. 21st Army Group, Operation Market Garden, Part 6, paragraph 28.

29. This synopsis of the general tactical situation on the Korean peninsula prior to the Inchon invasion is the result of study conducted with numerous sources including Clay Blair's Forgotten War, Max Hasting's Korean War, and Clayton James' The Years of MacArthur. My rendition conforms to the conventional interpretation of the events depicted in these sources.

30. D. Clayton James, The Years of MacArthur, Volume III, 1985, pg 469-470. This passage is a reproduction of General MacArthur's own recollection of the briefing. It is extracted from MacArthur's book Reminiscences, pages 349-350.

31. U.S. Army, FM 101-5-1, Operational Terms and Symbols, October 1985, pg 2-1.

32. Martin Van Creveld, Command in War, 1985, pg 194.

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